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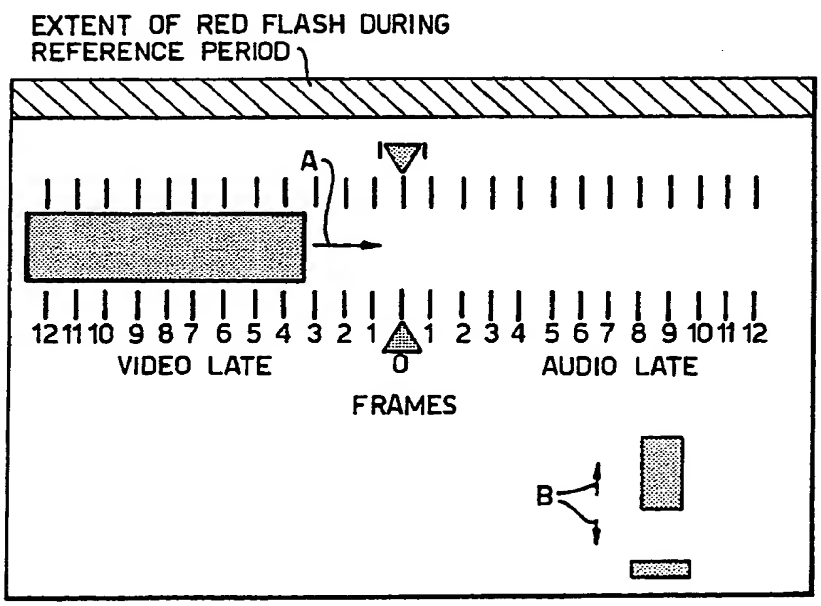
(54) Electronic clapperboard for television sound-vision synchronisation

(57) Apparatus for use in synchronising the sound and vision components of a television signal includes means for generating at intervals simultaneous sound and vision timing signals for incorporation into the television signal. The vision timing signal may comprise a red flash over a portion of the image area, which can be detected by eye, by an oscilloscope looking at the red component only, or by an automatic unit for example using a light pen. The vision timing signal may alternatively include a horizontally growing bar, or a vertical bouncing plunger, or may include the flash and horizontal bar or all three.

Fig.3.



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

Fig.1.

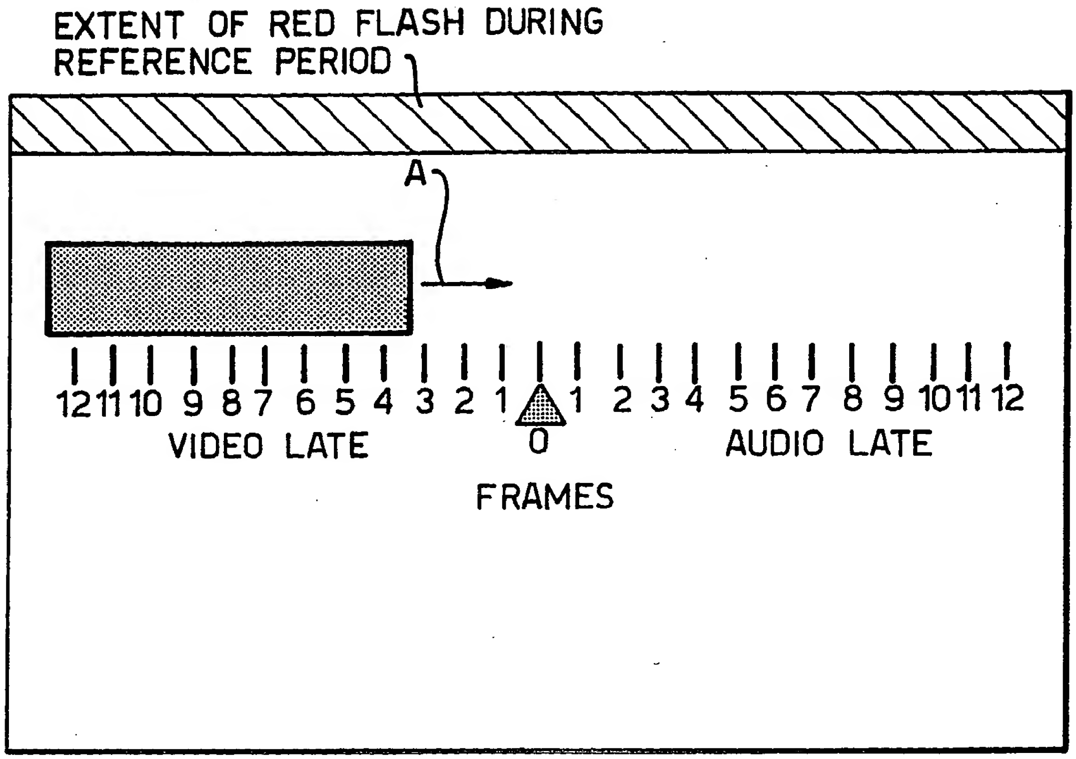

EXTENT OF RED FLASH DURING
REFERENCE PERIOD
A
12 11 10 9 8 7 6 5 4 3 2 1 1 2 3 4 5 6 7 8 9 10 11 12
VIDEO LATE
0
AUDIO LATE
FRAMES

Fig.2.

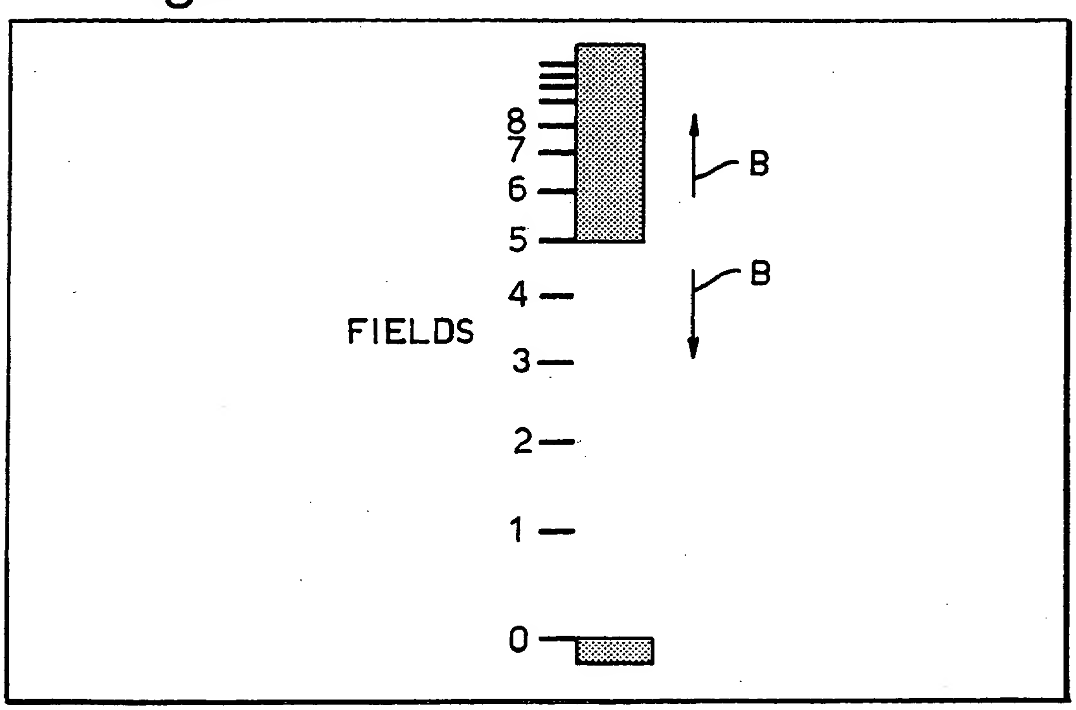
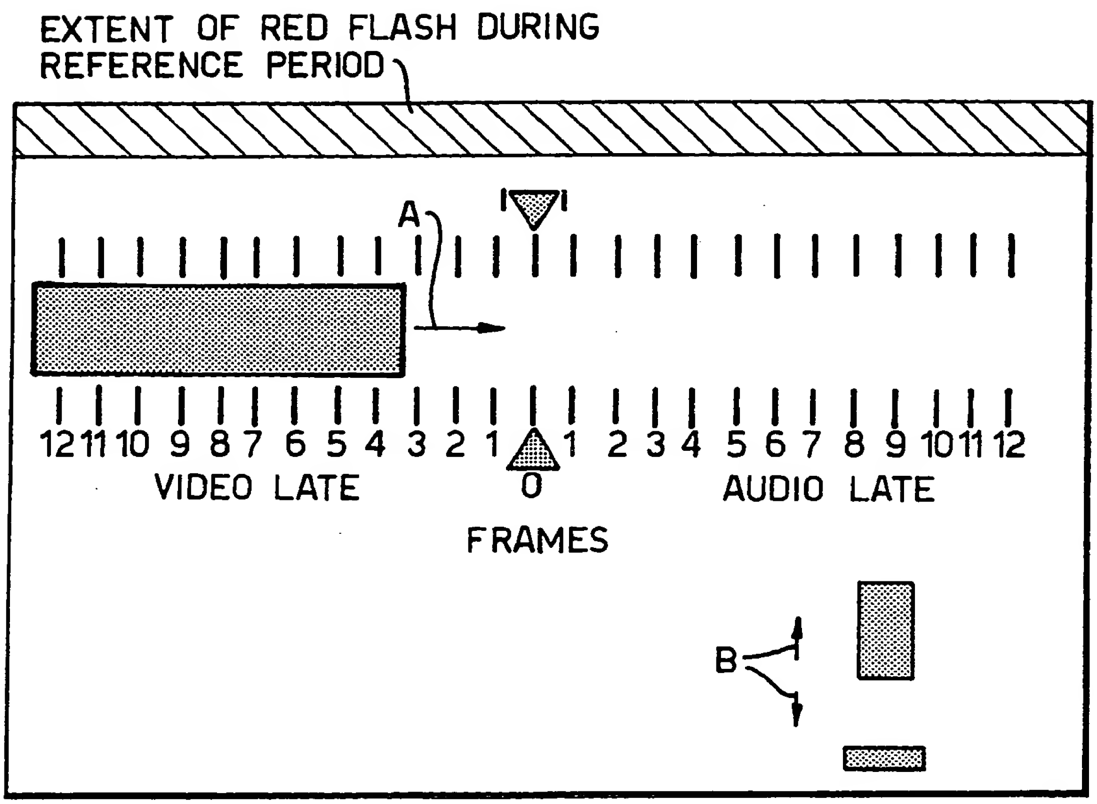

8
7
6
5
4
3
2
1
0
B
B
FIELDS

Fig.3.


EXTENT OF RED FLASH DURING REFERENCE PERIOD
A
12 11 10 9 8 7 6 5 4 3 2 1 1 2 3 4 5 6 7 8 9 10 11 12
VIDEO LATE
0
AUDIO LATE
FRAMES
B

IMPROVED ELECTRONIC CLAPPERBOARD FOR TELEVISION SOUND-VISION SYNCHRONISATION

This invention relates to apparatus for use in synchronising the sound and vision components of a television signal.

Difficulties are encountered in maintaining synchronization between audio and video material as a result of delays introduced by video and audio processing equipment. The problem is particularly apparent in high-definition television (HDTV) work, due to the increased use of such processing equipment. For example, when copying from D1 to D1 format, each transfer adds 1 frame of delay.

An audio-visual sequence is required which can be placed on a recording and used to assess the time offset between the audio and the video. An appropriate correction can then be made, by adjusting the setting of a synchroniser or by introducing an audio delay. The assessment can be done electronically or by a human observer. Such a sequence is known as a clapperboard sequence, by analogy with the clapperboard used in film studios, and an example of an electronic clapperboard is described in our United Kingdom Patent Application No. 2,243,969.

The clapperboard sequence should be designed so as to allow the offset to be measured to at least the nearest 5ms. This figure is chosen as being suitably small relative to the offsets which can be detected by human observers. Reports show that human observers can "detect" an offset if the sound is early by 20ms, or late by 40ms.

The present invention in its various aspects is defined in the independent claims appended to this description.

Preferred examples embodying the various aspects of the invention are described below with reference to the drawings. In these, apparatus for use

in synchronising the sound and vision components of a television signal includes means for generating at intervals simultaneous sound and vision timing signals for incorporation into the television signal. The vision timing signal comprises a red flash over a portion of the image area, which can be detected by eye, by an oscilloscope looking at the red component only, or by an automatic unit for example using a light pen. The vision timing signal also includes a horizontally growing bar, and a vertical bouncing plunger.

Brief Description of the Drawings

The invention in its various aspects will now be described by way of example with reference to the drawings, in which:-

Figure 1 is an example of a display produced by an electronic clapperboard which includes a red flash at the sync. point and a horizontally growing bar;

Figure 2 is a second example of a display which comprises a bouncing plunger; and

Figure 3 is a third example of a display including the features of both Figure 1 and Figure 2.

Detailed Description of the Preferred Embodiments

In accordance with this invention a synchronising sequence is generated which includes a single-colour flash over a part of the display on one field only. The rest of the sequence does not contain that colour. Thus the colour flash can readily be detected either by an automatic detector or by a user viewing an oscilloscope which displays the specified colour only.

In the preferred examples the flash is a red flash and is placed at the top of the picture for a period of one field, as shown in Figure 1. Detection is made easy by having the flash as the only signal present on the red channel. The flash is preferably a primary colour, but could be another colour, that colour then not being included anywhere else in the sequence.

Coincident with the red flash a sound "event" is generated. The television signal comprising the sound

and image sequence is then passed through the signal chain to be tested, and the timing of the flash and the sound event in the resultant output signal are compared.

As noted above, it is desirable to be able to measure the sound/vision offset to at least the nearest 5ms. Consider a sequence generated by using a device, held in front of a camera, which produced a click and flashed a light once a second. This would limit the potential timing accuracy of a measuring device to the field rate of the TV system. This is because the time at which the flash occurred would depend on its position in the picture and could be up to 20ms later than the click. However, by ensuring that the sound is generated at the same point in the TV field as the flash, this limitation would be removed. This can be achieved either by adding the sound at the correct point after the picture has been generated and recorded. Alternatively both the flash and the click can be generated together, using a device which is locked to the TV syncs.

A possible inaccuracy can occur due to the temporal difference between the illumination of the top and the bottom of the flash. If the flash is made only 50 lines high (in 625 line terms), the time taken to scan from the top to the bottom of the flash, taking interlace into account, is 1.6ms. Hence the time measured by the electronic timer would not depend greatly on which part of the flash was detected. The requirement for measurement to the nearest 5ms can easily be met.

The human assessor has to be able to determine the size and sense of the offset as well as whether the sources were in sync. This means that some form of movement is desirable so that the assessor can decide the position of the moving item at the moment of the audio event. This is discussed below.

The red flash is also illustrated in the arrangement of Figure 3, described below. It could be included in the system of Figure 2, either by reducing the size of the rest of the display, or by placing it to the left or right of the bouncing plunger, in a suitable

defined area of the picture.

Preferred Moving Visual Sequences

The rest of the display in its preferred form will now be described with reference to Figures 1, 2 and 3.

Figure 1 shows a sequence comprising a bar which moves across the screen in the direction of the arrow A and thus grows from the left-hand edge to the right. Its left-hand edge remains at the left-hand edge of the screen but the bar becomes gradually longer until it occupies the full width of the screen. Tick marks are placed at 1 frame intervals. The tick marks are labelled with offsets in frames and the mark corresponding to zero offset is indicated. The assessor decides which tick mark the edge of the block is passing at the moment of the click.

The sequences illustrated have been evaluated subjectively. For a moving object passing stationary tick marks, it was found that if the assessor watched the moving object, the ticks became blurred. This meant that he could not watch the moving object and decide which tick mark it was passing at the moment of the sound. His eyes could not be made to stop tracking the moving object suddenly, in order to view the tick marks. It was better to watch a particular tick mark, which instead made the moving object appear blurred, and to decide whether the click occurred before or after the object passed it.

The sequence of Figure 1 was very successful. The use of a growing bar created a good impression of movement. It was easy to tell which tick mark the bar was passing as the click was heard.

However, it was easy to be convinced that the sound was earlier relative to the video than in fact it was. This was probably due to practical experience of speed-of-sound delays. These mean that sound is usually perceived later than the visual event associated with it. As a result if a sound is heard after an event is seen, observers can be persuaded that the sound and light were generated at the same time and that the sound has taken

time to reach them. If the sound is heard before the event is seen, this seems unnatural to the observers and they cannot be persuaded that the events occurred at the same time.

This problem was overcome by developing a strategy for the assessor. The assessor considers each tick mark in turn, starting from the right hand edge (sound late) and progressing towards the left hand edge. The correct tick mark is the first one to be found which appears to correspond with the sound. This works because for tick marks to the right of the correct one, the sound is heard before the bar passes, which is unnatural. Tick marks to the left of the correct one, where the sound is heard after the bar passes, are not investigated by the observer. This avoids the problem of the observer choosing the wrong tick mark.

One drawback of the Figure 1 sequence is that it can be difficult to decide on the offset if the video is late by a large number of frames. These offsets correspond to points on the left hand side of the screen, where bar only disappears momentarily before reappearing. If accurately determining such offsets is important, another bar could be added. This bar's movement would be out of phase with the current bar, such that these offsets correspond to the centre of the screen.

Figure 2 shows a sequence which is based on the idea of a plunger moving up and down. A block grows downwards from the top of the screen and shrinks back upwards, as shown by the arrows B. The bottom of the block strikes a stationary block at the bottom of the screen at the exact synchronisation point, and "bounces" off. Tick marks are at one-field intervals. The bottom of the block could move either with constant acceleration, as though it was acted on by gravity, or with constant velocity.

In tests, the plunger with constant acceleration was preferred to that with constant velocity, as the motion seemed more natural. This meant that the observer could tell intuitively when it would strike the

stationary block which made it easier to decide whether the sound was heard at the same time. More generally, the bar moves increasingly faster the nearer it is to the stationary block.

The sequence was found to be quite useful for detecting whether or not the sources were synchronized. It was not very useful for determining the actual offset, due to the unequal distances between tick marks in the accelerating version. Another problem is that close to the sync point, the plunger is moving very quickly, so the steps are large and the movement is not very smooth. In addition, for half of the sequence the bar is getting smaller and this makes the edge less well defined due to persistence effects.

Figure 3 shows a sequence which includes features derived from both Figure 1 and Figure 2. It comprises a montage of the display of Figure 1 together with a small (200 lines high) version of the plunger of Figure 2 which moves under gravity. Several different versions of the plunger have been tried. In one version the plunger moves during the entire sequence. In the other versions the plunger is retracted for most of the sequence and only bounces for a few fields around the sync point. Plungers moving for each of 5 and 11 fields either side of the sync point have been produced. A very short plunger has been tried, only 100 lines high, and bouncing for 5 fields either side of the sync point.

The sequence of Figure 3 including the growing bar together with the small plunger was watched with each of the different plunger motions. The plunger which moved during the entire sequence was preferred to the other plungers, as it had a steady and predictable motion. All of the other plungers seemed too unpredictable. It was also counter-productive to have something happening, suddenly, just before the sync point, as it distracted attention from the main events happening at the sync point.

We have concluded that the growing bar of Figure 1 is the best sequence in allowing the observer to

estimate the time offset between the audio and the video. However, the inclusion of a small plunger as in Figure 3 can be useful as a final check that the sources are synchronized.

A final clapperboard sequence was chosen, consisting of a bar growing across the screen passing tick marks. At the sync point there is a flash at the top of the screen and a short wood-on-wood sound on the audio. Two versions of the sequence are possible one of which also includes a small plunger, which bounces vertically and strikes a stationary block at the sync point.

The full sequence is preferably about one second in length, so that delays of up to half a second (25 fields) can be accommodated. The sequence can be repeated continuously for a reasonable length of time, for example up to about two minutes, though a much shorter sequence may be sufficient.

The sequence of Figure 3 can be assessed in any of three different ways. Firstly, the clapperboard pattern can be assessed "by eye" off screen; secondly by viewing waveforms on an oscilloscope, this being possible because the red channel solely contains the red flash, or thirdly by an electronic measuring unit.

To detect the flash automatically a system using a light-pen which is pointed at the screen can be emplcyed. Alternatively a unit which accepts the red component of the RGB signal can be constructed. A simple timer circuit then compares the timing of the red flash with the sound on the audio channel.

CLAIMS

1. Apparatus for use in synchronising sound and vision components of a television signal, the apparatus comprising means for generating at intervals simultaneous sound and vision timing signal sequences for incorporation into the television signal, the vision timing signal comprising a flash on one field over a defined portion of the image area, the flash being of a predetermined colour.

2. Apparatus according to claim 1, in which the predetermined colour is a primary colour.

3. Apparatus according to claim 1 or 2, in which the vision component of the sequence does not contain any contribution of the predetermined colour other than the flash.

4. Apparatus for use in synchronising sound and vision components of a television signal, the apparatus comprising means for generating at intervals simultaneous sound and vision timing signal sequences for incorporation into the television signal, the vision timing sequence comprising a horizontal bar which grows from one side of the image area towards the other.

5. Apparatus for use in synchronising sound and vision components of a television signal, the apparatus comprising means for generating at intervals simultaneous sound and vision timing signal sequences for incorporation into the television signal, the vision timing sequence comprising a vertical bar which grows from an upper end downwardly to a datum position and then shrinks back upwardly again.

6. Apparatus according to claim 5, in which the bottom of the bar moves increasingly faster as it is nearer to the said datum position.

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

Application Number
GB 932108

Relevant Technical Fields

(i) UK Cl (Ed.L) H4F (FED, FHG, FJX); H4T (TBAX)

(ii) Int Cl (Ed.5) H04N (5/04 5/06 5/067)

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii) ONLINE DATABASE: WPI

Search Examiner
MISS S E WILLCOX

Date of completion of Search
6 JANUARY 1994

Documents considered relevant following a search in respect of Claims :-
1

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2243969 A (BBC) whole document	

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).